Dental Annuli Analysis as an Aid in the Determination of Copper Inuit Subsistence Strategies

by

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Dental Annuli Analysis as an Aid in the Determination of Copper Inuit Subsistence Strategies

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INTRODUCTION

The examination of dental annuli to determine age and/or season at death of mammals represented in archaeological sites has recently achieved considerable popularity. The technique has been utilized on fur seals (Gustafson 1968) white-tail deer (Kay 1974), red deer (Spiess 1979), harp and ringed seal (Spiess 1976, 1978), caribou (Spiess 1979; Gordon 1980, 1981), bison (Bourque _et al_. 1978), horse (Spiess 1979), and muskoxen (Savelle and Beattie 1981), among others.

Briefly, the method is based upon the seasonally related phenomenon in many northern mammals of variation in the rate of cementum deposition on individual tooth roots. This differential deposition results in a characteristic layering in the cementum analogous to tree rings. The number of 'rings' aids in age determination of the animal at death, while the extent of cementum deposition in the last formed 'ring' indicates the approximate time of death relative to the start of the 'summer' or 'winter' cycle. Although the exact physiological processes involved in annuli development are imperfectly understood, they are apparently related to seasonal variation in the amount of sunlight and nutritional qualities of summer and winter forage, at least among northern terrestrial mammals (McEwan 1963).

The reseach reported here represents a continuation of studies initiated by Savelle and Beattie (1981), who demonstrated the general utility of muskoxen dental annuli as an aid in determining site seasonality. In addition to describing a different technique (i. e. decalcification and staining vs. standard thin-sectioning), this study also focusses upon age and season of death of selected muskoxen material collected from a nineteenth century Copper Inuit site located on the northeast coast of Banks Island, N.W.T. These results are compared with seasonality determinations made by Savelle and Beattie on other Banks Island Copper Inuit sites.

MATERIAL

A total of 13 teeth were chosen for analysis from site BPW-29. This site extends over an area of approximately 2600 square meters, and contains the remains of at least 75 muskoxen. Right mandibles were collected from this habitation location in order to 1) determine the season or season(s) during which muskoxen were utilized and 2) isolate activity areas that might be seasonally related. Complete and fragmentary mandibles were sampled so that seasonal variation in mandibular marrow extraction might also be accessed. Four complete right mandibles

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from a cluster of 11 were collected in the vicinity of a stone tent-ring and cache. Other specimens were selected at random from north, south and east site locations. Where possible, right m1's were extracted for sectioning. If m1's were misssing, right m3's were utilized instead.

METHODS

The preparation technique employed was a modification of the method developed by Miller (1974:12) and included:

1. removing one of the tooth roots by cutting slightly above the root/pad interface,
2. decalcifying root by immersion for 24 hours in 7.5% commercial nitric acid (commercial grade = approximately 67%),
3. dehydrating root by immersion in ethyl alcohol,
4. removing alcohol by immersion in xylene,
5. immersing in liquid paraffin wax,
6. embedding in paraffin wax,
7. longitudinal sectioning of root to approximately 30 microns utilizing a microtome. Longitudinal sections are preferable in that, as noted by Miller (1974:23), they allow the observer to determine more accurately the origins, splitting, merging, and phasing out of annuli.
8. grinding cut section to approximately 15 microns by hand on a frosted glass plate with distilled water lubricant

9. mounting ground section on microscope slide using Ames mounting compound,
10. staining of mounted section using hematoxylin (5-30 minutes),
11. mounting of cover slip using Fisher's Premount.

Finished stained sections were examined under 160 and 400 X magnification using transmitted white light. Annuli were best defined in the middle 1/3 of the root.

INTERPRETATION OF ANNULI

Unfortunately, there are no published reports available on cementum development for muskoxen inhabiting Banks Island, or Canada for that matter. Muskoxen teeth examined from Greenland by Grue and Jensen (1979) and Henrichsen and Grue (1980), showed that the normal period for development of 'winter' (incremental) lines was September through to February, although 100% development was observed only in muskoxen killed in November.

Season of Death

Since cementum widths vary slightly from year to year, determination of death season is necessarily subjective, and a high degree of precision is excluded. In the present study, any specimen in which a thin light annulus followed a dark annulus was classified as a 'spring' kill (approximately March - May), a light annulus about one half the thickness of the preceeding light annulus as a 'summer' kill (approximately June - August), a light annulus approximately the same thickness as the preceeding light annulus, or a very thin dark annulus indicating initial development, as a 'fall' kill (approximately September - November), and finally, any specimen which exhibited a well -developed dark annulus was classified as a 'winter' kill (approximately December - February).

Age at Death

In muskoxen, mandibular first molars are loose in the alveolus at birth (May), are erupting by six months, and are fully erupted and showing wear by 12 months (Henrichsen and Grue 1980:9). Furthermore, incremental lines in muskoxen apparently develop in unerupted teeth (op. cit.:13). Thus, except for very young individuals, mandibular first molars are ideal for determining age at death, the number of incremental lines (winter lines) reflecting accurately the number of winters an animal has lived. When mandibular third molars were used, age was determined by adding two to the number of incremental lines observed, since m3's do not develop until 24 months in muskoxen. It should be noted that false annuli (i.e. the cementum-dentine interface) were generally easily distinguished from true annuli by their comparative thinness and abrupt change in texture/structure at that point.

RESULTS

Reliable age readings were obtained on all 13 decalcified and stained thin sections. The difference between annuli and eruption age determinations are minor. Eruption criteria provide a reliable means for aging animals up to about five years. All tooth structures have erupted and undergone some amount of wear beyond this age (Henrichsen and Grue 1980). Annuli counts provide a more accurate method for aging individuals older than five years. As shown in Table 1, 9 of the 13 mandibles belonged to animals five years old or less. Two individuals were aged more than 11 years.

Estimated season of death for each muskox is also summarized in Table 1. Three of the 13 specimens could not be deciphered. An additional three specimens provided ambiguous results indicating summer or fall deaths. Six of the remaining 7 samples showed clearly that the season of death had been fall (September to November). A single specimen indicated that death had occurred during spring.

Although the results are not conclusive, the primary procurement of muskoxen in the vicinity of BPW-29 seems to have taken place during the late summer and/or fall. Fall utilization is also corroborated by the fact that several tent-ring structures are characterized by excavated floors indicating a cold-trap function. Fall readings for teeth extracted from

Table 1

Summary of Season and Age at Death for Muskox Tooth Specimens Collected from Site BPW - 29

Specimen	Location	Age(annuli)	Age(eruption/wear)	Season of Death
BPW - 1a	sq. 162/44	1.5 yrs.	2.5-3.0 yrs.	Fall
BPW - 1b	" "	2.5	2.5-3.0	Fall
BPW - 1c	" "	3.5	4.0	Fall
BPW - 1d	" "	4.5	4.5+	Fall?
BPW - 2	sq. 154/54	6.0+	4.5+	?
BPW - 3	sq. 124/62	4.5	4.0	Fall
BPW - 4	sq. 166/30	3.5	4.0	Summer or Fall
BPW - 5	sq. 162/68	11.0+	4.5+	?
BPW - 6	sq. 128/32	7.0+	4.5+	?
BPW - 7	sq. 164/38	12.0	4.5+	Spring
BPW - 8	sq. 164/46	2.5	2.0	Fall
BPW - 9	sq. 164/42	4.5	4.0+	Fall
BPW - 10	sq. 126/64	5.0	4.0	Summer?

complete and fragmentary mandibles suggest that marrow extraction was dependent upon a number of variables in addition to fall animal nutritional status. The single incident of a spring kill indicates the opportunistic procurement of animals, perhaps when Copper Inuit were coming in off the ice from their winter sealing encampments.

Savelle and Beattie (1981:5) derive two conclusions from their analysis of 23 muskox teeth collected from Copper Inuit kill sites, and a large base camp known as Head Hill near the confluence of the Muskox and Thomsen Rivers. First, kill sites, as evidenced by the presence of skulls and/or other axial skeletal parts from one or more animals were produced during early and mid-summer. Second, the large Copper Inuit habitation site was occupied during spring and fall. No summer readings were obtained from the Head Hill site.

The analysis of dental annuli from muskox teeth collected from Banks Island Copper Inuit sites supports the seasonally based subsistence strategy hypothesized by Hickey (1980) on the basis of other archaeological data. Continued study of muskox tooth specimens from additional Copper Inuit sites along the Thomsen River, as well as the the northeast Banks Island coast, will provide further elucidation of inter-site and intra-site variation in muskox procurement and utilization.

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